CLAIMS

1. An electron beam irradiation apparatus characterized by comprising:

a rotary driving unit for rotationally driving an object to be rotated;

a shield container for rotatably accommodating the object; and

an electron beam irradiation unit provided in said shield container so that the surface of the object is irradiated with electron beams from an irradiation window thereof,

wherein the surface of the object is irradiated with the electron beams during its rotation from said irradiation window of said electron beam irradiation unit.

2. An electron beam irradiation apparatus according to claim 1, wherein said electron beam irradiation unit emits the electron beams under a low acceleration voltage.

3. An electron beam irradiation apparatus according to claim 1 or 2, wherein the acceleration voltage of said electron beam irradiation unit is 20 kV through 100 kV.

4. An electron beam irradiation apparatus according to any one of claims 1 through 3, wherein an interior of said shield container is set in an atmosphere of an inert gas, and

said shield container is provided with a gas introduction port and a gas discharge port from which the inert gas flows

in the vicinity of said irradiation window.

5. An electron beam irradiation apparatus according to claim 4, wherein a temperature sensor is provided in the vicinity of said irradiation window, and

a flow rate of the inert gas is adjusted based on a temperature measured by said temperature sensor.

6. An electron beam irradiation apparatus according to any one of claims 1 through 5, wherein an oxygen concentration meter for measuring an oxygen concentration within said shield container, is provided.

7. An electron beam irradiation apparatus according to any one of claims 1 through 6, wherein a vacuumizing device for depressurizing the interior of said shield container is provided.

8. An electron beam irradiation apparatus according to any one of claims 1 through 7, wherein the object has a disc shape, and

an area extending in at least one radial direction of the surface of the object is irradiated with the electron beams.

9. An electron beam irradiation apparatus according to any one of claims 1 through 8, wherein the object has a disc shape,

said electron beam irradiation unit includes a plurality of

electron beam irradiation tubes, and

each of said electron beam irradiation tubes irradiates each of a plurality of areas on the surface with the electron beams.

10. An electron beam irradiation apparatus according to any one of claims 1 through 8, wherein a shutter member is disposed between said irradiation window and the surface of the object, and

a shutter driving mechanism moves said shutter member between an opening position of permitting transmission of the electron beams emitted from said irradiation window and a closing position of blocking the electron beams, thus controlling switchover of the irradiation and non-irradiation of the electron beams upon the surface of the object.

11. An electron beam irradiation apparatus according to claim 10, wherein the switchover is conducted so that a quantity of emission of the electron beams is set large when said shutter member is in the opening position and set small when said shutter member is in the closing position.

12. An electron beam irradiation apparatus according to any one of claims 1 through 11, wherein said shield container is openable and closable and is composed of a metallic material, and has a shielding structure for shielding the electron beams emitted from said irradiation window.

13. An electron beam irradiation method characterized by comprising:

rotationally driving an object to be rotated accommodated in a shield container that can be air-tightly closed; and

irradiating the surface of said on-rotating object with the electron beams from an irradiation window of an electron beam irradiation unit.

14. An electron beam irradiation method according to claim 13, wherein said electron beams irradiation unit emits the electron beams of which an acceleration voltage is 20 kV through 100 kV.

15. An electron beam irradiation method according to claim 13 or 14, wherein an interior of said shield container is depressurized and is thereafter replaced with an inert gas atmosphere by introducing an inert gas.

16. An electron beam irradiation method according to claim 15, wherein a flow rate of the inert gas is controlled while measuring an oxygen concentration within said shield container.

17. An electron beam irradiation method according to claim 15 or 16, wherein the inert gas is flowed through the vicinity of said irradiation window toward a gas discharge port from a gas introduction port, thereby cooling off the vicinity of

said irradiation window.

18. An electron beam irradiation method according to claim 17, wherein a flow rate of the inert gas is adjusted based on a temperature measured by a temperature sensor provided in the vicinity of said irradiation window, thereby controlling a cooling temperature.

19. An electron beam irradiation method according to any one of claims 13 through 18, wherein the object has a disc shape, and

an area, extending in at least one radial direction, on the surface is irradiated with the electron beams.

20. An electron beam irradiation method according to any one claims 13 through 19, wherein the object has the disc shape, and

a plurality of electron beam irradiation tubes of said electron beam irradiation unit irradiate each of a plurality of areas with the electron beams.

21. An electron beam irradiation method according to any one claims 13 through 20, wherein a shutter member disposed between said irradiation window and the surface of the object is moved between an opening position of permitting transmission of the electron beams emitted from said irradiation window and a closing position of blocking the

electron beams, thus controlling switchover of the irradiation and non-irradiation of the electron beams upon the surface of the object.

22. An electron beam irradiation method according to claim 21, wherein the switchover is conducted so that a quantity of emission of the electron beams is set large when said shutter member is in the opening position and set small when said shutter member is in the closing position.

23. An electron beam irradiation apparatus characterized by comprising:

a rotary driving unit for rotationally driving an object to be rotated;

a shield container for rotatably accommodating the object;

an electron beam irradiation unit provided in said shield container so that the surface of the object is irradiated with electron beams from an irradiation window thereof;

a shutter member disposed between said irradiation window and the surface of the object and movable between an opening position of permitting transmission of the electron beams emitted from said irradiation window and a closing position of blocking the electron beams; and

a shutter driving mechanism for moving said shutter member so as to effect switchover to the irradiation and non-irradiation of the electron beams during a rotation of the object,

wherein the object has a disc shape, and an area, extending in a radial direction, on the surface is irradiated with the electron beams from said irradiation window.

24. An electron beam irradiation apparatus according to claim 23, wherein said electron beam irradiation unit includes a plurality of electron beam irradiation tubes disposed in the radial direction on the surface.

25. An electron beam irradiation apparatus according to claim 24, wherein said plurality of electron beam irradiation tubes are so arranged as to substantially uniformize a distribution of irradiation beam intensities of the electron beams in the radial direction.

26. An electron beam irradiation apparatus according to claim 25, wherein a period of electron beam irradiation time is controlled corresponding to a radial position of the object so as to substantially equalize an integrated irradiation dose of the electron beam irradiation in the radial direction.

27. An electron beam irradiation apparatus according to claim 25 or 26, wherein said shutter member is constructed to start, when opened, opening in an outer peripheral position and to gradually open toward an inner peripheral position on the surface of the object.

28. An electron beam irradiation apparatus according to any one of claims 25 through 27, wherein an aperture is formed extending in the radial direction,

the switchover to the irradiation and the non-irradiation of the electron beams is performed by opening and closing said aperture through a movement of said shutter member, and

the electron beam irradiation time is controlled corresponding to the radial position of the object, depending on a relative position between said shutter member and said aperture and on a moving speed of said shutter member.

29. An electron beam irradiation apparatus according to claim 24, wherein said plurality of electron beam irradiation tubes are arranged to obtain such a distribution that an irradiation beam intensity of the electron beams is high on the outer peripheral side but low on the inner peripheral side in the radial direction.

30. An electron beam irradiation apparatus according to claim 29, wherein said shutter member is constructed to open and close at a comparatively higher speed than a rotating speed of the object.

31. An electron beam irradiation apparatus according to any one of claims 1 through 27, 29 and 30, wherein an aperture is formed extending in the radial direction, and

the switchover to the irradiation and the non-irradiation

of the electron beams is performed by opening and closing said aperture through a movement of said shutter member.

32. An electron beam irradiation method characterized by comprising:

a step of rotationally driving an object to be rotated accommodated in a shield container that can be air-tightly closed;

a step of irradiating the surface of said on-rotating object with the electron beams from an irradiation window by moving a shutter member provided between the surface of the object and said irradiation window of an electron beam irradiation unit; and

a step of stopping the irradiation of the electron beams by blocking the electron beams in a way that moves said shutter member after the irradiation of the electron beams for a predetermined period of time.

33. An electron beam irradiation method according to claim 32, wherein said electron beams irradiation unit has an acceleration voltage ranging from 20 kV to 100 kV.

34. An electron beam irradiation method according to claim 32 or 33, wherein an interior of said shield container is depressurized and is thereafter replaced with an inert gas atmosphere by introducing an inert gas.

35. An electron beam irradiation method according to claim 34, wherein the inert gas is flowed through the vicinity of said irradiation window toward a gas discharge port from a gas introduction port, thereby cooling off the vicinity of said irradiation window.

36. An electron beam irradiation method according to any one of claims 32 through 35, wherein the object has a disc shape, and

an area, extending in a radial direction, on the surface is irradiated with the electron beams from said irradiation window.

37. An electron beam irradiation method according to claim 36, wherein the irradiation of the electron beams is effected by a plurality of electron beam irradiation tubes, serving as said electron beam irradiation unit, arranged in the radial direction of the surface.

38. An electron beam irradiation method according to claim 37, wherein said plurality of electron beam irradiation tubes are so arranged as to substantially uniformize a distribution of irradiation beam intensities of the electron beams in the radial direction, and

a period of electron beam irradiation time is controlled corresponding to a radial position of the object so as to substantially uniformize a distribution of an integrated

irradiation dose of the electron beam irradiation in the radial direction.

39. An electron beam irradiation method according to claim 38, wherein said shutter member starts opening in an outer peripheral position and gradually opens toward an inner peripheral position on the surface of the object, thereby controlling the electron beam irradiation time.

40. An electron beam irradiation method according to claim 37, wherein said plurality of electron beam irradiation tubes are arranged to obtain such a distribution that an irradiation beam intensity of the electron beams is high on the outer peripheral side but low on the inner peripheral side in the radial direction.

41. An electron beam irradiation method according to claim 40, wherein said shutter member is opened and closed at a comparatively higher speed than a rotating speed of the object.

42. An apparatus for manufacturing a disc-shaped object, comprising an electron beam irradiation apparatus according to any one of claims 1 through 12 and claims 23 through 31,

characterized in that a resin layer and/or a surface layer formed on the object serving as a disc-shaped object is cured by the irradiation of the electron beams.

43. A method of manufacturing a disc-shaped object, involving the use of an electron beam irradiation apparatus according to any one of claims 1 through 12 and claims 23 through 31, or an electron beam irradiation method according to any one of claims 13 through 22 and claims 32 through 41, characterized in that a resin layer and/or a surface layer formed on the object serving as a disc-shaped object is cured by the irradiation of the electron beams.

44. An apparatus for manufacturing a disc-shaped object, characterized by comprising:

an air-tightly closable chamber including: an electron beam irradiation apparatus having a first rotational unit provided in an openable/closable shield container and accommodating a disc-shaped object, and an electron beam irradiation unit irradiating the surface of the disc-shaped object with electron beams from its irradiation window; and an exchange chamber having a second rotational unit capable of accommodating the disc-shaped object and air-tightly closable and openable/closable independently of said shield container; and

a rotary unit for exchanging said first rotational unit in said shield container and said second rotational unit in said exchange chamber with each other by rotating said first rotational unit and said second rotational unit.

45. An apparatus for manufacturing a disc-shaped object,

characterized by comprising:

an air-tightly closable chamber including: an electron beam irradiation apparatus having a first rotational unit provided in an openable/closable shield container and accommodating and rotationally driving a disc-shaped object, and an electron beam irradiation unit irradiating the surface of said on-rotating disc-shaped object with electron beams from its irradiation window; and an exchange chamber having a second rotational unit capable of accommodating the disc-shaped object and air-tightly closable and openable/closable independently of said shield container; and

a rotary unit for exchanging said first rotational unit in said shield container and said second rotational unit in said exchange chamber with each other by rotating said first rotational unit and said second rotational unit.

46. An apparatus for manufacturing a disc-shaped object according to claim 44 or 45, wherein said electron beam irradiation unit emits the electron beams of which an acceleration voltage is 20 kV through 100 kV.

47. An apparatus for manufacturing a disc-shaped object according to claim 44, 45 or 46, wherein the surface of the disc-shaped object moving into said shield container by rotating said second rotational unit in said exchange chamber, is irradiated with the electron beams emitted from said electron beam irradiation unit, and

said first rotational unit, accommodating the disc-shaped object after being irradiated with the electron beams, in said shield container is rotated and thus transferred into said exchange chamber.

48. An apparatus for manufacturing a disc-shaped object according to any one of claims 44 through 47, wherein said shield container includes a fixed unit forming a first air-tightly closed space in cooperation with said first or second rotational unit and provided with said electron beam irradiation unit,

said exchange chamber includes a third rotational unit forming a second air-tightly closed space in cooperation with said second or first rotational unit and capable of attaching and detaching the disc-shaped object,

in a state where said chamber is air-tightly closed, said first rotational unit moves to and from said fixed unit, and said second rotational unit moves to and from said third rotational unit, thereby exchanging the disc-shaped object,

said third rotational unit opens the second air-tightly closed space and rotates while holding the disc-shaped object, thereby ejecting the post-irradiation disc-shaped object, and

a different fourth rotational unit rotates toward said second rotational unit and exchanges the pre-irradiation disc shaped object in a way that supplies the disc-shaped object to said second rotational unit.

49. An apparatus for manufacturing a disc-shaped object according to claim 48, wherein said electron beam irradiation unit irradiates the electron beams within said first air-tightly closed space during the exchange of the disc-shaped object by said third and fourth rotational units.

50. An apparatus for manufacturing a disc-shaped object according to any one of claims 44 through 49, wherein a shutter member disposed between said irradiation window of said electron beam irradiation unit and the surface of the disc-shaped object and is moved by a shutter driving mechanism between an opening position of permitting transmission of the electron beams emitted from said irradiation window and a closing position of blocking the electron beams, thereby controlling switchover to the irradiation and non-irradiation of the electron beams upon the surface of the disc-shaped object.

51. An apparatus for manufacturing a disc-shaped object according to any one of claims 44 through 50, wherein an interior of said exchange chamber is depressurized and is thereafter replaced with an inert gas atmosphere.

52. An apparatus for manufacturing a disc-shaped object according to any one of claims 44 through 51, wherein the inert gas flows in the vicinity of said irradiation window, thereby cooling off said irradiation window.

53. An apparatus for manufacturing a disc-shaped object according to any one of claims 44 through 52, wherein said shield container is composed of a metallic material, and

a shielding portion for shielding the electron beams is provided at an abutting portion between said first rotational unit and said fixed unit.

54. A method of manufacturing a disc-shaped object, characterized by comprising:

a step of irradiating the surface of a disc-shaped object accommodated in a rotational unit within an air-tightly closed space with electron beams of which an acceleration voltage is 20 kV through 100 kV; and

a step of opening the air-tightly closed space, rotating said rotational unit and, in linkage with this operation, rotating a different rotational unit accommodating another disc-shaped object, thereby exchanging the post-irradiation disc-shaped object with the pre-irradiation disc-shaped object.

55. A method of manufacturing a disc-shaped object, characterized by comprising:

a step of irradiating the surface of an on-rotating disc-shaped object while rotationally driving the disc-shaped object accommodated in a rotational unit within an air-tightly closed space with electron beams of which an acceleration voltage is 20 kV through 100 kV; and

a step of opening the air-tightly closed space, rotating said rotational unit and, in linkage with this operation, rotating a different rotational unit accommodating another disc-shaped object, thereby exchanging the post-irradiation disc-shaped object with the pre-irradiation disc-shaped object.

56. A method of manufacturing a disc-shaped object according to claim 54 or 55, further comprising a step of forming a resin layer and/or a surface layer on the pre-irradiation disc-shaped object,

wherein the resin layer and/or the surface layer is cured by the irradiation of the electron beams.